State Water Resources Control Board

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DATE: May 12, 2004 (revised June 2, 2004)

SUBJECT: **IMPERIAL VALLEY DRAINS SILT TMDL: ECONOMIC IMPACT ASSESSMENT**

The staff of the TMDL (Total Maximum Daily Load) Coordination Unit, of the Colorado River Basin Regional Water Quality Control Board, has requested that the Economics Unit of the State Water Resources Control Board estimate the economic impacts of implementing the proposed silt TMDL for three specific drains flowing directly into the Salton Sea.

SUMMARY

The implementation of the silt TMDL will probably increase total production costs by less than one percent for field crops and vegetables. For non-vegetable row-crops, sediment retention costs represent about 2 percent of total production costs. Table 1 presents a summary of silt reduction costs for the three drains. The estimated costs range from a high of just under $200,000 to a low of over $22,000 for the 10,463 acres that are drained. The high cost scenario assumes the installation of sediment ponds or fiber strips. Grass strips are used in the low cost scenario. Average per acre costs range from just under $20 to over $2 per acre.

Table 1. Summary of TMDL Silt Reduction Costs

Drain	Drained Acres	High Drainage Costs	Low Drainage Costs
Niland 2 Drain	1,675	$20,787	$3,689
P Drain	909	$18,270	$1,943
Pumice Drain	7,879	$159,493	$17,186
Total	**10,463**	**$198,549**	**$22,818**
Total Costs per Acre		**$18.98**	**$2.18**

INTRODUCTION

The objective of this analysis is to estimate the change in costs and returns of implementing the TMDL for silt reduction on land being drained by three drains that flow directly into the Salton Sea. These drains are located on the southeast shore of the Salton Sea (Figure 1).

For the purposes of the economic analysis, it was assumed that the set of existing farming practices for each crop provides the largest profit margin, and is therefore the least expensive set of practices, and any change in these methods would result in higher costs to the grower. Included in this analysis is the costs related to alteration of existing farming practices in order to reduce sediment discharge from cropland. The cost of monitoring to be incurred by Imperial Irrigation District (IID) and the cost savings of maintenance accruing to the IID as a result of reduced sediment inflow into the drainage canal system are not included.

Also excluded from this estimate is the cost of compliance with IID Regulation No. 39 that requires maintenance and repair of the previously-installed standard "Tailwater Drop Boxes", with a maximum drop of 12 inches from field grade to top board height. Separate field surveys, performed in late 1999 and late 2000, indicated that a portion of these drop boxes are damaged, and that many are being used with drop elevations in excess of 12 inches, resulting in field edge erosion. Since the maintenance of these structures is mandated by IID regulation, any costs incurred in repairing the existing damaged units are excluded from the current estimate.

Also excluded from this estimate are any costs that may be associated with any future TMDLs, not related to the current sediment TMDL for irrigated agriculture that may be developed for this region. The specific proposals have not yet been developed, and may not be completed for several years. Therefore, it is impossible at this time to determine the costs associated with the implementation of other possible standards.

The analysis of farming-practice costs related to reducing sediment loss was limited to an examination of current agricultural practices. The reduction of the quantity of sediment discharged into the agricultural drainage canals, from land being farmed, can be achieved by altering existing irrigation-related farm management practices. The amount of land erosion from an individual field, and subsequent sediment discharge into the drainage system, is dependent upon the following factors:

1. Flow rate of water runoff;
2. Flow rate of water inflow;
3. Soil type;
4. Slope,
5. Irrigation method;
6. Field size;
7. Crop;
8. Tailwater ditch characteristics;
9. Drop structure characteristics.

Figure 1. Surface Drains Subject to Allocations of the Imperial Valley Drain Silt TMDL.

Of these various factors, it is generally agreed that the most important factor is the flow rate of water runoff, or irrigation discharge. The second most important factor may be the soil type or the cover provided by the crop being irrigated. Alfalfa will not erode as readily as a typical row crop but crop type may require specific irrigation methods and thus affect sediment reduction costs. Field size also affects sediment retention costs because of the inherent economies of size in some techniques such as sediment ponds and drainage filters.

MANAGEMENT PRACTICES

The Imperial Valley Sedimentation/Siltation TMDL Technical Advisory Committee (Silt TMDL TAC) submitted a list of possible irrigation-related farm management practices that could result in reduced sediment discharge. This list consisted of eight somewhat-related practices involving the control of drainage water. The University of California Cooperative Extension (UCCE) staff of Imperial Valley Research Field Station prepared an additional list of ten management practices. These ten practices have some overlap with the eight submitted by the TAC and a combined list of approximately twelve to fifteen management practices was formulated that could be incorporated into existing farming practices. These practices were assumed to be applicable to the Imperial Valley Agricultural Drains Subwatershed and to the subject of this analysis, the drains flowing directly to the Salton Sea.

A small number of the suggested silt reduction practices are economically feasible. Management practices that were judged to be economically effective in reducing sedimentation include:

1. Installation of biodegradable FIBERMAT filter strips in the drainage ditches. These can be used at strategic locations in the drainage area to act as water "speed bumps", to slow the surges of tailwater leaving the field through the drop-boxes. The per acre cost of using FIBERMAT filter strips decrease as field size increases.

2. Construction of wide-profile drainage ditches incorporating grass-planted filter strips. As the grass roots hold the soil, and the grass itself acting to slow the movement of the tailwater, the tailwater surges would become less erosive. The per acre cost of wide profile ditches and grass-planted filter strips decrease as field size increases.

3. Construction of sediment basins to contain drainage water in order to allow suspended sediments to settle out. The captured sediments are dredged out periodically. Sediment basins are suitable for fields larger than 140 acres.

4. Employing an additional irrigator to monitor the irrigation and employ alternative irrigation techniques. Employment of additional irrigating labor will not necessarily result in reductions in applied water, but will result in elimination of the surges of discharge water, identified as the primary cause of sediment discharge. The cost of improving the management of irrigation water does not fluctuate with respect to field size.

Each of these management practices is feasible under certain conditions. These conditions can be crop-specific or field-specific. In some cases, individual preference may also be a factor. In addition, more than one practice may be needed to adequately reduce sediment losses from a specific field.

COSTS OF MANAGEMENT PRACTICES

Costs associated with the individual irrigation management practices were estimated from material suppliers and contractors and are summarized in Table 2 by four field sizes and several crop types. Cost estimation procedures and assumptions are presented in Appendix I. Annual costs range from a low of just over $2 per acre for the grass lined, wide-profile ditch servicing a 160-acre field to a high of about $42 per acre for additional vegetable and row crop irrigation labor used on a small field.

As seen in Table 2, costs of sediment retention decrease as field size increases and therefore plays a significant role in determining the costs of achieving the TMDL and estimating the economic impact to growers.

Table 2. Costs of Sediment Retention Management Practices.

Practice	Cost per Acre per Year			
	40 Acres	**60 Acres**	**80 Acres**	**160 Acres**
Fibermat Filter Strips	$32.56	$26.58	$23.02	$16.28
Grass Filter Strips				
3-year Installation	$5.99	$4.89	$4.24	$3.00
5-year Installation	$4.28	$3.49	$3.02	$2.14
Sediment Pond	—	—	—	$20.10
Addition Irrigation Labor				
Veg & Row Crops				
Lettuce	$31.50	—	—	—
Cotton	$35.00	—	—	—
Melons	$28.00	—	—	—
Watermelons	$35.00	—	—	—
Carrots	$28.00	—	—	—
Onions	$42.00	—	—	—
Hay Crops				
Alfalfa	—	—	$9.20	—
Sudan	—	—	$3.45	—

The drains that flow directly into the Salton Sea that are subject to allocations in this TMDL are: the Niland 2 Drain, the P Drain and the Pumice Drain. GIS parcel maps were available from the Imperial Irrigation District indicating location, size, and ownership. Land use was determined by field inspection.

NILAND 2 DRAIN

Parcels drained by the Niland 2 Drain are shown in Figure 2 and described in Table 3. Some of the parcels are owned by the same person and located adjacent to each other therefore they could be drained by the same filter strip or sediment pond, which would result in reduced drainage costs. By combining parcels in this manner, none of the resulting field sizes fall below the 80 acre threshold which also eliminates the use of additional irrigation labor as a silt reduction management option (Table 2). A high and low per acre drainage costs presented in Table 2 were used to calculate total high and low field drainage costs for the Niland 2 Drain (Table 3).

Drainage costs for the Niland 2 Drain were estimated to range between $20,787 and $3,789 for the 1,675 irrigated acres being drained. High average drainage costs for the Drain is $12.41 per acre which is considerably lower than the $20.10 per acre presented in Table 2. The lower average cost is due to the practices that would be required in the 737 acre wildlife habitat area owned by the State of California. The wildlife habitat is not subject to high silt production because of the intensive ground cover and the unexposed soil. Therefore they will not require sediment ponds or expensive filter strips to achieve the objectives of the TMDL. The low average drainage costs is $2.20 per acre.

P Drain

The P Drain has the potential to drain 2,381 acres however most of the area is idle or in non agricultural uses. Total drained acreage is 909. Two of the parcels have the potential to be combined into one drained area. Installing sediments ponds on all of the drained parcels would result in total drainage costs of $18,270. Using grass strips to reduce silt production would result in a total cost of $1,943. Because of the parcel sizes approximate 160 acres or larger, average drainage costs for the P Drain reflect the high and low cost alternatives presented in Table 2.

Pumice Drain

The Pumice Drain is the largest drain included in this TMDL with a total parcel acreage of 8,341 and a total irrigated acreage of 7,879. The area also has a geothermal power a plant and other industrial land uses. Twenty five parcels were combined into twelve drainage areas resulting in a majority of the drained areas being about 160 acres or larger with five of the parcels being in the 80 acre range. Costs of silt retention ranges from a high estimate of $159,493 to a low of $17,186.

Conclusions

Considering the amount of reduction in soil erosion, and subsequent delivery to the drainage system, the cost increases associated with the practices reviewed appear reasonable. Some farmers will probably implement other changes in the current irrigation practices, changes that result in a reduced peak volume of discharge. Better management of water discharges will reduce sediment outflow, and in many cases also reduced water inflow.

If you have any questions, please call me at (916) 341-5279.

cc: Catherine George, OCC

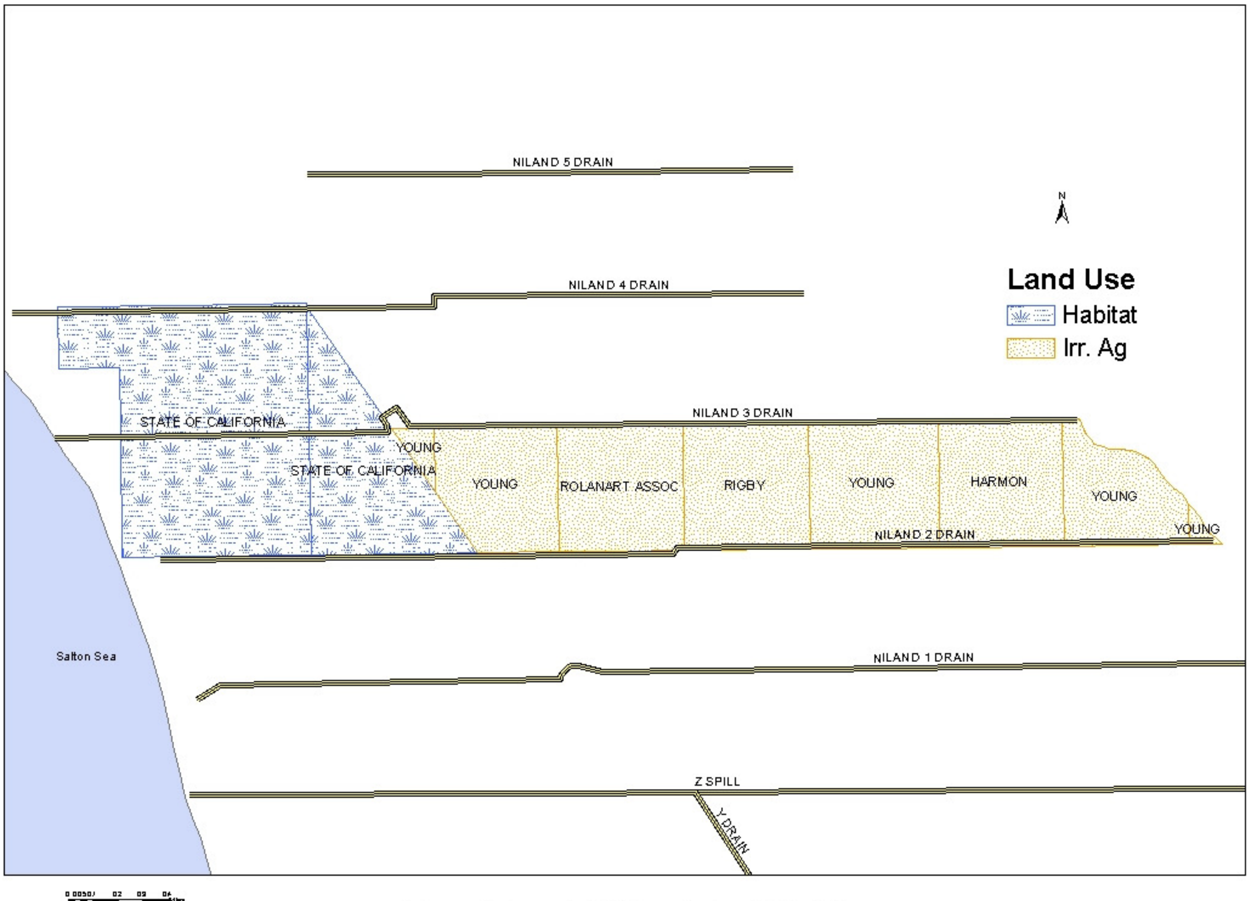

Figure 2. Imperial Valley Drains Silt TMDL
Niland 2 Drain Parcels

Table 3. Niland 2 Drain Parcels

Parcel ID	Parcel Owner	Land Use	Parcel Acres	Drained Acres	High Drainage Costs	Low Drainage Costs
116	HARMON	Irr. Ag	163	163	$3,276	$348
118	RIGBY	Irr. Ag	162	162	$3,256	$346
119	ROLANART ASSOC	Irr. Ag	162	162	$3,256	$346
99	STATE OF CALIFORNIA	Habitat	525	525	$1,122	$1,122
100	STATE OF CALIFORNIA	Habitat	212	212	$453	$453
117	YOUNG	Irr. Ag	169	169	$3,397	$361
120	YOUNG	Irr. Ag	145			
121	YOUNG	Irr. Ag	14	159	$3,196	$340
115	YOUNG	Irr. Ag	117			
123	YOUNG	Irr. Ag	6	123	$2,831	$372
Total			**1,675**	**1,675**	**$20,787**	**$3,689**
Total Costs per Acre					**$12.41**	**$2.20**

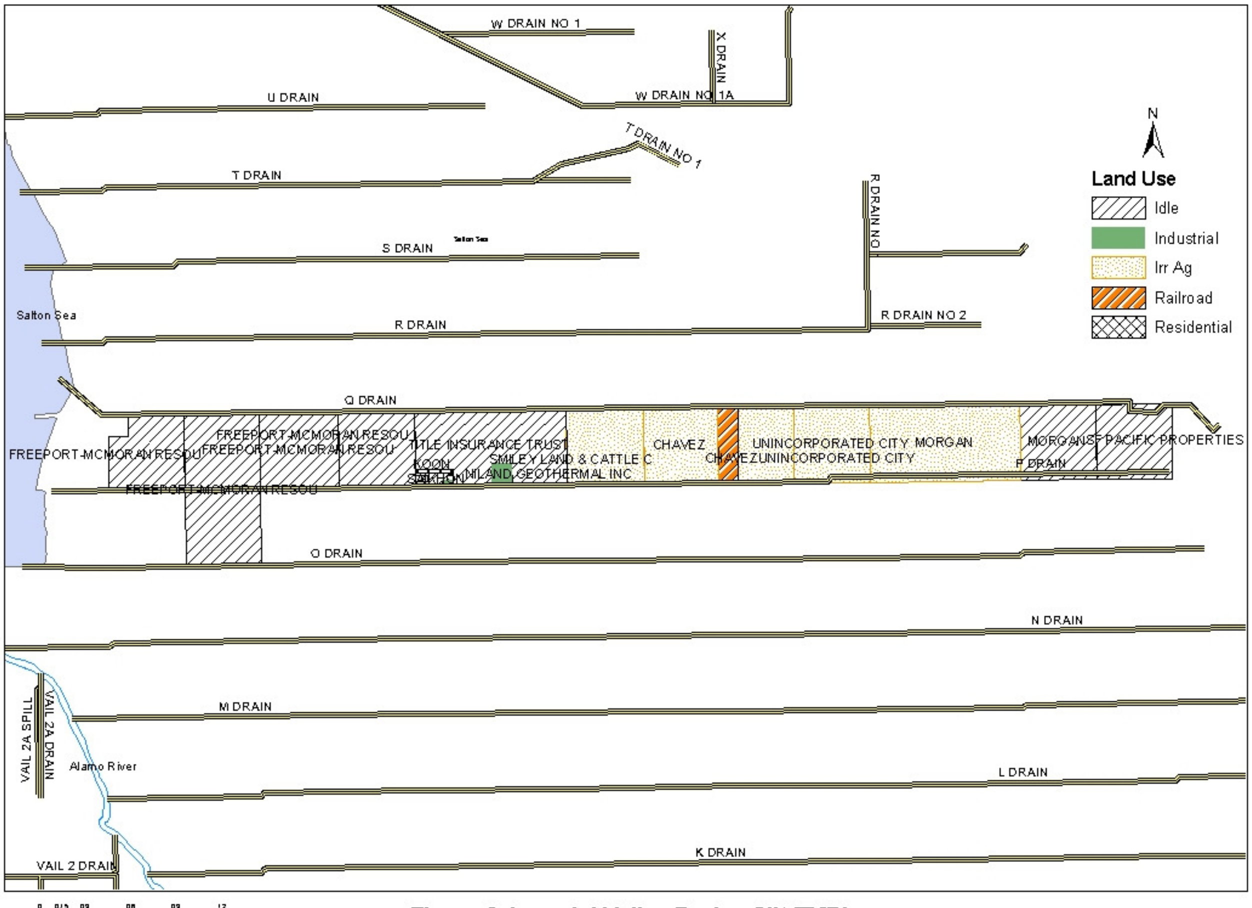

Figure 3. Imperial Valley Drains Silt TMDL
P Drain Parcels

Table 4. P Drain Parcels

Parcel ID	Parcel Owner	Land Use	Parcel Acres	Drained Acres	High Drainage Costs	Low Drainage Costs
580	CHAVEZ	RR	42	0		
581	CHAVEZ	Irr Ag	155	155	$3,115	$331
587	FREEPORT-MCMORAN RESOURCE	Idle	149	0		
586	FREEPORT-MCMORAN RESOURCE	Idle	320	0		
585	FREEPORT-MCMORAN RESOURCE	Idle	167	0		
584	FREEPORT-MCMORAN RESOURCE	Idle	161	0		
602	IID	Industrial	1			
600	KOON	Residential	1	0		
599	KOON	Residential	0	0		
597	KOON	Residential	4	0		
576	MORGAN	Idle	158	0		
577	MORGAN	Irr Ag	315	315	$6,331	$673
594	NILAND GEOTHERMAL INC	Industrial	13	0		
598	SAIKHON	Idle	10	0		
575	SF PACIFIC PROPERTIES INC	Idle	158	0		
582	SMILEY LAND & CATTLE CO	Irr Ag	163	163	$3,276	$348
583	TITLE INSURANCE TRUST CO	Idle	288	0		
578	UNINCORPORATED CITY	Irr Ag	159			
579	UNINCORPORATED CITY	Irr Ag	117	276	$5,547	$590
Total			**2,381**	**909**	**$18,270**	**$1,943**
Total Costs per Acre					**$20.10**	**$2.14**

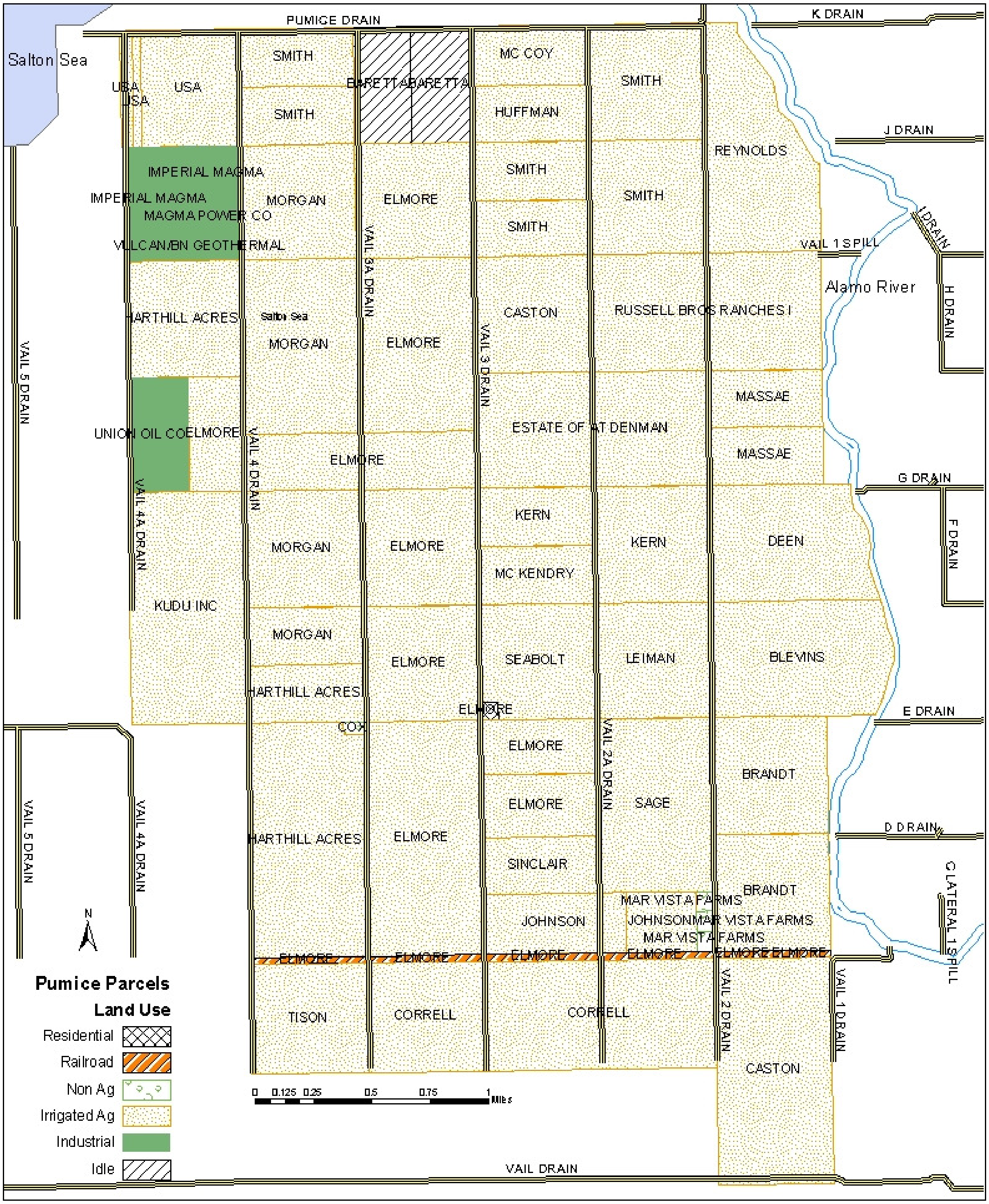

Figure 4. Imperial Valley Drains Silt TMDL
Pumice Drain Parcels

Table 5. Pumice Drain Parcels

Parcel ID	Parcel Owner	Land Use	Parcel Acres	Drained Acres	High Drainage	Low Drainage
754	BARETTA	Idle	81	0		
755	BARETTA	Idle	78	0		
935	BLEVINS	Irr Ag	240	240	$4,824	$513
985	BRANDT	Irr Ag	160			
1057	BRANDT	Irr Ag	159	319	$6,411	$682
828	CASTON	Irr Ag	159	159	$3,196	$340
1147	CASTON	Irr Ag	310	310	$6,231	$663
1151	CORRELL	Irr Ag	151	151	$3,035	$323
1149	CORRELL	Irr Ag	300	300	$6,030	$641
989	COX	Non Ag	3	0		
888	DEEN	Irr Ag	216	216	$4,341	$462
783	ELMORE	Irr Ag	156			
829	ELMORE	Irr Ag	240	396	$7,959	$846
854	ELMORE	Irr Ag	73	73	$1,680	$221
863	ELMORE	Irr Ag	159	159	$3,196	$340
891	ELMORE	Irr Ag	161			
938	ELMORE	Irr Ag	159	320	$6,432	$684
955	ELMORE	Residential	3	0		
987	ELMORE	Irr Ag	75			
1008	ELMORE	Irr Ag	85	160	$3,216	$342
988	ELMORE	Irr Ag	324	324	$6,512	$693
1125	ELMORE	RR	4	0		
1126	ELMORE	RR	4	0		
1127	ELMORE	RR	9	0		
1128	ELMORE	RR	9	0		
1129	ELMORE	RR	9	0		
1131	ELMORE	RR	9	0		
853	ESTATE OF AT DENMAN	Irr Ag	315	315	$6,331	$673
831	HARTHILL ACRES	Irr Ag	159	159	$3,196	$340
990	HARTHILL ACRES	Irr Ag	322			
948	HARTHILL ACRES	Irr Ag	79	401	$8,059	$857
765	HUFFMAN	Irr Ag	78	78	$1,796	$236
785	IMPERIAL MAGMA	Industrial	40	0		
786	IMPERIAL MAGMA	Industrial	69	0		

Table 5(cont.). Pumice Drain Parcels

Parcel ID	Parcel Owner	Land Use	Parcel Acres	Drained Acres	High Drainage	Low Drainage
1074	JOHNSON	Irr Ag	50			
1075	JOHNSON	Irr Ag	102	152	$3,055	$325
890	KERN	Irr Ag	79			
889	KERN	Irr Ag	161	240	$4,824	$513
893	KUDU INC	Irr Ag	318	318	$6,391	$680
936	LEIMAN	Irr Ag	159	159	$3,196	$340
799	MAGMA POWER CO	Industrial	22	0		
1073	MAR VISTA FARMS	Non Ag	4	0		
1076	MAR VISTA FARMS	Non Ag	4	0		
1088	MAR VISTA FARMS	Non Ag	4	0		
862	MASSAE	Irr Ag	78			
852	MASSAE	Irr Ag	77	155	$3,115	$331
753	MC COY	Irr Ag	83	83	$1,911	$251
911	MC KENDRY	Irr Ag	79	79	$1,819	$239
784	MORGAN	Irr Ag	157			
830	MORGAN	Irr Ag	240	397	$7,979	$849
892	MORGAN	Irr Ag	161			
939	MORGAN	Irr Ag	79	240	$4,824	$513
751	REYNOLDS	Irr Ag	243	243	$4,884	$519
826	RUSSELL BROS RANCHES INC	Irr Ag	323	323	$6,492	$690
986	SAGE	Irr Ag	240	240	$4,824	$513
937	SEABOLT	Irr Ag	153	153	$3,075	$327
1058	SINCLAIR	Irr Ag	76	76	$1,750	$230
752	SMITH	Irr Ag	159			
781	SMITH	Irr Ag	155	314	$6,311	$671
756	SMITH	Irr Ag	79			
764	SMITH	Irr Ag	79	158	$3,176	$338
782	SMITH	Irr Ag	81			
801	SMITH	Irr Ag	76	157	$3,155	$336
1152	TISON	Irr Ag	152	152	$3,055	$325
855	UNION OIL CO	Industrial	84	0		
757	USA	Irr Ag	133			
758	USA	Irr Ag	11			
759	USA	Irr Ag	16	160	$3,216	$342
805	VULCAN/BN GEOTHERMAL	Industrial	26	0		
Total			**8,341**	**7,879**	**$159,493**	**$17,186**
Total Costs per Acre					**$20.24**	**$2.18**

APPENDIX I

COST CALCULATIONS OF SILT REDUCTION MANAGEMENT PRACTICES

FIBERMAT COST CALCULATIONS

FIBERMAT - FULL INSTALLATION

Install C 350 FIBERMAT on a conventional drainage ditch

C 350 FIBERMAT is approximately 1 3/8 inches thick, useful life approximately 3 years and biodegradable.
Sample FIBERMAT costs from Ewing Irrigation 916/447-9530 (Mark Thomas and John Shering)
To build a fibermat ditch to serve 40, 60, 80, or 160 acres of farmland assuming a square field.

Cost of Material

			Dimensions (ft.)	
Parameter	Value	Unit	Width	Length
Cost/roll	$185.00	meters	2	30
Cost/running ft.	$1.88	feet	6.56	98.43

Cost by Field Size

Installation Cost: $0.18 /foot
Maintenance Cost: $0.30 /foot
Useful Life: 3 years

		Field Dimension		Material Cost		Cost/acre/year		
Field Size	Unit	Width (ft)	Length (ft)	Per Acre	Per Year	Installation	Maintenance	Total
40	acre	1,320	1,320	$62.03	$20.68	$1.98	$9.90	$32.56
60	acre	1,617	1,617	$50.64	$16.88	$1.62	$8.08	$26.58
80	acre	1,867	1,867	$43.86	$14.62	$1.40	$7.00	$23.02
160	acre	2,640	2,640	$31.01	$10.34	$0.99	$4.95	$16.28

Install C 125 FIBERMAT on a conventional drainage ditch

C 125 FIBERMAT is approximately 5/8 inches thick, useful life of 1 year and biodegradable..
To build a fibermat ditch to serve 40, 60, 80, or 160 acres of farmland assuming a square field.

Cost of Material

			Dimensions (ft.)	
Parameter	Value	Unit	Width	Length
Cost/roll	$120.00	meters	2	30
Cost/running ft.	$1.22	feet	6.56	98.43

Cost by Field Size

Installation Cost: $0.18 /foot
Maintenance Cost: $0.30 /foot
Useful Life: 1 year

		Field Dimension		Material Cost		Cost/acre/year		
Field Size	Unit	Width (ft)	Length (ft)	Per Acre	Per Year	Installation	Maintenance	Total
40	acre	1,320	1,320	$40.23	$40.23	$5.94	$9.90	$56.07
60	acre	1,617	1,617	$32.85	$32.85	$4.85	$8.08	$45.78
80	acre	1,867	1,867	$28.45	$28.45	$4.20	$7.00	$39.65
160	acre	2,640	2,640	$20.12	$20.12	$2.97	$4.95	$28.04